

## PATENT SPECIFICATION



Application Date: June 28, 1929. No. 19,863/29.

335,611

(Patent of Addition to No. 309,470: dated Jan. 11, 1928.)

Complete Left: March 28, 1930.

Complete Accepted: Sept. 29, 1930.

## PROVISIONAL SPECIFICATION.

## Improvements in or relating to Control Means for Brakes.

We, THE INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS COMPANY LIMITED, of 108, Cannon Street, London, E.C. 4, a British Company, and WILLIAM LEICESTER AVERY, of the said Company's Works at Silvertown, London, E. 16, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention consists in improvements in or relating to control means for brakes.

According to this invention a control means for controlling two brakes or two series of brakes has an operating rod which is mounted so as to be capable of movement transversely to its longitudinal axis and also capable of rotational or angular movement about its longitudinal axis, one of the said movements of the rod effecting simultaneous similar application or alteration in application of both of said brakes or series of brakes, while the other of said movements effects in one direction application of or increase in application of one brake or one series of brakes only and in the other direction application of or increase in application of the other brake or other series of brakes only. When one brake or one series of brakes only is applied or increased in application by the said movement of the rod the other brake or brakes may simultaneously be decreased in application.

Preferably the movement of the operating rod transverse to its longitudinal axis effects simultaneous similar application or alteration in application of said brakes or series of brakes, while rotational or angular movement of said rod about its longitudinal axis in one direction effects application of or increase of application of one brake or one series of brakes only and similar movement of the rod in the other direction effects application of or increase in application of the other brake or other series of brakes only.

Preferably the rod is mounted so that angular movement about its longitudinal axis can be given thereto at any position which it may have reached consequent upon a prior movement thereof in a direction transverse to its longitudinal axis.

Conveniently the operating rod is mounted so as to be angularly movable about an axis transverse to its longitudinal axis to effect similar application of or alteration in application of the brakes or series of brakes.

This invention is particularly adapted for use with brakes for wheels of aeroplanes as it is advantageous for aeroplanes when taxiing to be steered by the greater or less braking force to the wheels on one side of the machine than to the wheels on the other side.

This invention is conveniently adaptable for use with brakes actuated by fluid pressure.

One form of control means according to this invention has two fluid containing chambers, one adapted to be connected to one brake or one group of brakes and the other to another brake or another group of brakes, and an operating rod, movement of which in a direction transverse to its longitudinal axis alters the capacity of both said chambers equally, while angular movement of the said rod about its longitudinal axis alters the capacity of only one of said chambers or increases the capacity of one and decreases the capacity of the other simultaneously.

In one construction of control means according to the preferred way of carrying out this invention as applied to control means for use with brakes actuated by fluid pressure, the control means comprises two hollow cylinders fixed side by side with their longitudinal axes parallel and in the same horizontal plane. The ends of said cylinders are closed and slidable within each is a hollow cylindrical piston which in the "at rest" position of the control means extends from one end (hereafter termed the rear end) of the cylinder forwards toward the other or forward end of the cylinder. The forward end of each of said pistons is closed and provided with suitable packings or washers to prevent fluid in the portion of the cylinder forward therefrom from escaping past the forward end of the piston to the rear portion of the cylinder.

55

60

65

70

75

80

85

90

95

100

The forward portion of each of the said cylinders are adapted to contain oil or other brake actuating fluid medium and have conduits extending therefrom one of which is connected in use to one brake or group of brakes and the other to the other brake or group of brakes.

The rear portions of the said cylinders are cut away on their facing sides and the pistons so exposed are provided with horizontal opposing slots, the longitudinal centre lines of which lie in the plane in which the longitudinal centre lines of the cylinders lie. Within each of the said pistons and secured to the wall thereof which is remote from the other piston is a toothed rack, which also lies in the said plane and extends from the rear of the piston towards the forward end thereof. The said racks are so disposed and of such dimensions that the teeth of each lie approximately on the longitudinal axis of the respective piston. It will be appreciated that the said racks will face each other and be exposed to each other through the slots in the facing sides of the pistons.

Extending vertically upwards from the said cylinders are a pair of spaced but connected triangular brackets. The base of each of said brackets extends lengthwise of and is secured to the said cylinders, the vertex of each being located above the rear portions of the said cylinders. Mounted in gimbal bearings at and between the vertices of said brackets is a sleeve, through which passes the operating rod of the control means. The mounting of said sleeve is such as to permit it to swing in a vertical plane which intersects the plane in which the axes of the cylinders lie, mid-way between the said axes.

The said operating rod extends from both ends of the said sleeve and is angularly movable therein about its longitudinal axis. Collars secured to said rod at both ends of the sleeve prevent endwise movement of the said rod. The upper end of the said rod carries a suitable handle and the lower end extends between the cylinders and penetrates the horizontal plane in which their axes lie. The bottom extremity of the said rod is of square section and carries slidably upon it a sleeve which has a correspondingly square interior. The said sleeve has a circular flange which extends radially therefrom at right angles to the longitudinal axis of the rod. Secured at its inner periphery to the said flange is an annular disc of flexible material such as rubber impregnated laminated fabric, the outer peripheral margin of said disc being secured to a flange extending radially inwardly from a ring having a toothed

outer periphery which, on either side of the rod, enters the slots in the piston sides and engages the toothed racks secured to said pistons. Extending radially outwardly on either side of the toothed ring and secured thereto are circular guide flanges which extend above and below the racks and maintain the ring in engagement therewith.

It will be appreciated that rearward movement of the upper end of the said operating rod will move both of the pistons equally forward and that rotational or angular movement of the said rod about its axis in one direction will move one piston forward (or one forward and the other rearward where both have been moved forward previously) and rotational or angular movement in the opposite direction will correspondingly move the other piston. Movements of the piston, of course, give corresponding actuation of the brakes or series of brakes.

The described connection of the toothed ring to the end of the operating rod allows for variation in the angle which the rod makes with the horizontal plane and allows angular movement of the rod about its axis with corresponding movement of the piston or pistons at all positions of said rod.

Many modifications could be made to the control means described. For instance, instead of the engagement between the operating rod and the piston comprising a toothed wheel and rack mechanism, a plain ring of somewhat greater diameter than the toothed ring may be employed, the said ring having vertical pivot pins on each side of the rod where the longitudinal axes of the pistons meet it. A link pivoted on each of said pivot pins to swing thereabout in a horizontal plane would extend forwardly therefrom approximately on the longitudinal axis of the respective piston to the rear of the closed end of the said piston, being suitably pivoted thereto. Instead of extending forwardly each link may extend rearwardly from the ring to a pivot extending vertically across the rear end of the piston.

While the control means has been described with the cylinders horizontally disposed it will be appreciated that this is only for convenience in description and that they may be disposed in a vertical or an oblique plane in use.

If desired the operating rod may be cranked above the point at which it is mounted to move angularly about a transverse axis (i.e. above the gimbal mounted sleeve in the specific description), the said cranking being in the direction in which the rod is moved to effect equal and simultaneous application of or withdrawal of

the said brakes. In such a case the rotational or angular movement of the said rod about its axis would be obtained by movement of the cranked extremity of the rod in a direction transverse to that in which it is moved to effect equal application of the brakes. In the case of an aeroplane the cranked end of said rod could be connected to the usual control rod or popularly termed "joy-stick" of the aeroplane so that the two required movements would be obtained, one by forward and rearward movement of the "joy-stick" and the other by lateral movement of the "joy-stick".

In another construction of control means the chambers or cylinders instead of being disposed side by side could be disposed end to end, their rear ends being adjacent. With such an arrangement the operating rod could operate the pistons through rack and toothed wheel having the same general arrangement as that described, the racks extending opposite to

one another and being spaced apart by offsetting the cylinders or otherwise to receive the toothed wheel between them. With such an arrangement rotational or angular movement of the rod about its longitudinal axis would effect equal and simultaneous application of both brakes or both series of brakes while transverse movement of the rod to one side would effect application of one brake or one series of brakes and similar movement of the rod to the other side would effect application of the other brake or other series of brakes.

In some cases instead of having cylinders with pistons sliding therein, the chambers may each have a flexible wall or diaphragm pressure upon which restricts the capacity of the said chamber and thus applies the brake connected thereto.

Dated this 28th day of June, 1929.

A. G. BROWN,

Acting for the Applicants.

### COMPLETE SPECIFICATION.

#### Improvements in or relating to Control Means for Brakes.

We, THE INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS COMPANY LIMITED, of 106, Cannon Street, London, E.C. 4, a British Company, and WILLIAM LEICESTER AVERY, of the said Company's Works at Silvertown, London, E. 16, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention consists in improvements in or relating to control means for brakes actuated by fluid pressure and to that type of control means for such brakes (what now follows is that which is hereafter referred to as "the type described") which comprises a pair of fluid receiving chambers, one of which is adapted to be connected to one brake unit, and the other to another brake unit (said brake units each comprising a single brake or a group of brakes), each of said chambers having means (for example a piston or the like co-operating with the chamber) by movement of which relatively to the chamber the effective volume of said chamber is reduced (in the case of brakes applied by positive fluid pressure) to expel fluid from the chamber to the brake unit connected thereto, or increased (in the case of brakes applied by negative pressure) to suck fluid into the chamber from the brake unit connected thereto and thus (in both

cases) apply the brake or brakes of the brake unit connected with the chamber, the control means having an operating rod which is mounted so as to be capable of at least two movements, one of said movements causing such relative movement between the aforesaid means of both chambers and their respective chambers as to expel fluid from or suck fluid into both chambers and so apply the brakes of both brake units, while the other movement of the operating member in one direction causes such relative movement between the aforesaid means of only one chamber and its chamber as to expel fluid from or suck fluid into said chamber only and so apply only the brake or brakes connected to said chamber, and the said movement of the operating member in the other direction causes such movement between the aforesaid means of only the other chamber and its chamber as to expel fluid from or suck fluid into said chamber only and so apply only the brake or brakes connected to said chamber.

One form of the type of control means described provides the subject matter of British Patent No. 309,470 of the invention claimed in which the present invention is a modification, and in the control means described in the said patent specification the aforesaid two movements are both movements of the operating rod transverse to its longitudinal axis.

According to the present invention in a control means of the type described, one of the aforesaid movements of the operating rod is a movement transverse to its longitudinal axis and the other movement is a rotational or angular movement about its longitudinal axis.

Preferably the operating rod can be moved transversely or rotationally with reference to its longitudinal axis after it has been previously moved from its normal position of rest rotationally or transversely respectively with reference to its longitudinal axis.

Preferably the movement of the rod transverse to its longitudinal axis effects the application of the brakes of both brake units, and the angular or rotational movement of the rod about its longitudinal axis in one direction effects application of the brake or brakes of one brake unit only and in the other direction the brake or brakes of the other brake unit only.

Where, after a movement of the rod to effect the application of the brakes of both brake units, a movement is given to the rod to effect the further application of the brake or brakes of one brake unit only this further movement may also effect the partial or complete release of the brake or brakes of the other brake unit.

The accompanying drawing illustrates by way of example one form of control means for brakes according to this invention for use with liquid (e.g. oil) pressure operated brakes.

Figure 1 is an end view of the control means, viewing it from what is hereafter regarded as the front end.

Figure 2 is a vertical sectional view on the line 2-2 in Figure 1.

Figure 3 is a plan view, partly in section on the line 3-3 in Figure 1.

Figure 4 is a sectional view on the line 4-4 in Figure 3.

Figure 5 is a sectional view of a detail.

Referring to the drawings, the control means comprises a pair of cylinders 10 11 disposed side by side and formed preferably by a single casting. Each cylinder has slidable within it a piston 12 both of which face in the same direction. Each piston comprises a cap 13 which is threaded on to a skirt 14 with an annular washer 15 gripped between the said cap and skirt.

The wall between the two cylinders rearward from the extreme rearward position of the pistons (i.e. that shown in the drawings) is cut away and the rear ends of the cylinders are closed by a closure member 16 from which parallel spaced horizontal cheeks 17 and 18 project into the cylinders, said cheeks extending across both cylinders. Rivetted to said cheeks

and extending therefrom further into the cylinders are spaced parallel plates 19 and 20, plate 19 being secured to the underside of cheek 17 and plate 20 to the upper side of cheek 18.

Extending rearwardly and centrally from each piston cap 13 is a projection 21 which is formed integral with cap 13 and has a rearwardly decreasing taper. Loosely fitting over each projection 21 and extending rearwardly therefrom axially of each cylinder between the plates 19, 20 is a tubular member 22 which is internally of circular section and externally of square section so as to be a close but freely slidable fit between the said plates 19 20. Each member 22 is secured to its projection 21 so as to be endwise movable therewith by a pin 23 which passes vertically through the projection and the said member 22. The pin is a tight fit in the projection, but the holes in the member 22 which its ends enter are elongated transversely of the member so that the said member is free to adjust itself laterally thereon to a small extent.

The face 24 of each member 22 which is toward the vertical longitudinal plane between the cylinders has a longitudinally extending toothed rack formed upon it. The face 25 of each said member remote from the face 24 engages vertical guide rollers 26 27 which are mounted upon pins extending between the plates 19, 20.

Disposed between the plates 19 20 between and meshing with the toothed rack members 23 is a toothed wheel 28, which has spaced flared holes 29 and 30 each of which is engaged by a prong of the forked end 31 of an operating rod 32, the said prongs being circular in cross section. The rod 32 extends upwardly between the cylinders through longitudinally extending slots in the plate 19 and in the wall between the cylinders thereabove, into and through a casing 33 which is mounted in a gimbal bearing as shown in Figure 5, between brackets 34, 35 which extend upwardly from and are formed integrally with the cylinders. The said bearing is such that the casing 33 with the rod 32 can swing thereabouts in a longitudinally extending vertical plane which intersects midway between the axes of the cylinders the horizontal plane in which the said axes lie.

The casing 33 is oval in cross-section for the purpose of adding strength to the rod, its major dimension lying in the plane in which it swings in its bearing. The rod 32 is rotatable about its longitudinal axis in the casing 33, the top and bottom ends of the casing being constricted by suitable filling pieces so as to maintain the rod centrally therewithin. The

bottom end 36 only of the casing is seen in the drawings. The rod 32 extends beyond the casing 33 at its top end and is provided with a handle of suitable shape whereby it can be moved with the casing transversely to its longitudinal axis in the aforementioned vertical plane, or moved angularly within the casing about its longitudinal axis.

10 it will be appreciated that moving the upper end of the rod rearwardly transversely to its longitudinal axis in the aforesaid vertical plane will cause the toothed wheel 28 to move forwardly, taking with it both the members 22 and thus thrusting both pistons 12 forwardly in the cylinders 10, 11. On the other hand rotational or angular movement of the rod 32 within the casing and about its longitudinal axis will cause rotation of the wheel 28 and thus, in a clockwise direction, effect forward movement of the piston in cylinder 11 and, in an anti-clockwise direction, forward movement of the piston in cylinder 10.

The brackets 34 35 are provided with bushes 37 to receive the pivots 38 of the casing 33 and have slots 39 through which the pivots 38 can pass, but through which the bushes 37 cannot pass. It will be appreciated that to remove the casing 33 with the rod 32 from the brackets 34 35, the bushes 37 are first removed endwise, allowing the pivots 38 to leave the brackets through the slots 39.

The front ends of the cylinders 10 11 are each provided with connector tubes 40, 41, tube 40 being in use connected with the brake or brakes to be operated and tube 41 with a liquid supply whence any loss of liquid in the cylinders is replaced. The communication between each tube 41 and its cylinder is controlled by a spring urged cone valve 42 as described in our co-pending patent application No. 28,670 of 1929. The stem 43 of the valve extends through a central aperture 44 in the piston cap 13 into a longitudinal bore 45 in the projection 21. The end of the stem has an enlargement 46 which cannot pass through the aperture 44. The length of the stem is such that when the piston approximates to its extreme rearward position the valve 42 is lifted off its seating so as to establish communication between the liquid supply and the cylinder. At all other positions of the piston 12 the valve is held by its spring and also by the pressure of the liquid in the cylinder on to its seating, thus preventing egress of liquid from the cylinder to the supply.

The universal engagement of the rod 32 with the toothed wheel 28 may be effected in other ways from that shown. For

example the end of the rod may be centrally secured to a flexible disc, located within a toothed wheel of annular form, the periphery of said disc being clamped to the internal periphery of the wheel.

The valve communication between the cylinder and the fluid supply forms no part of this invention and may be omitted from control means according to this invention.

While it is preferred that the movement of the rod transverse to its longitudinal axis should effect application of both brakes or both sets of brakes and rotational movement of the rod about its longitudinal axis effect in one direction application of one brake or one set of brakes only and in the other direction application of the other brake or other set of brakes only, yet in some cases the functions of the movements may be reversed, that is to say, the rotational movement of the rod may effect equal application of the brakes and the transverse movement may in one direction effect application of one brake or one set of brakes only and in the other direction application of the other brake or other set of brakes only. This would, for example, be the case in a control means which differed from that described in that the pistons in the cylinders faced in opposite directions, causing in consequence application of both brakes or sets of brakes when thrust in opposite directions.

The thrusting of the pistons in opposite directions would of course be effected by the rotation of the toothed wheel and thus of the operating member, the transverse movement of the rod thrusting only one piston forwardly and moving the other rearwardly, thus effecting the application of one brake or one set of brakes only.

Instead of the cylinders being disposed side by side they may in some cases be arranged end to end.

If desired the operating rod may be cranked above the axis about which it is movable transversely to its longitudinal axis, the said cranking being in the direction in which the rod moves transversely to effect application of the brakes. In such a case the rotational or angular movement of the rod about its longitudinal axis would be obtained by movement of the cranked extremity of the rod in a direction transverse to that in which the rod is movable transversely to its longitudinal axis. In the case of an aeroplane the cranked end of the rod could be connected to the usual control rod or "joy-stick" of the aeroplane so that the two required movements would be obtained, one by a forward or rearward movement of the "joy-stick" and the other by lateral movement

of the "joy-stick".

In some cases instead of having cylinders with pistons sliding therein, the chambers may each have a flexible wall or diaphragm by means of which the volume of the chamber is reduced or enlarged. Again the chambers may be in the form of bellows members, which may be fixed at one end and have the other end movable backwards and forwards in relation thereto.

While the example given has relation to brakes operated by fluid pressure it will be appreciated that the invention is also applicable to control means for brakes operated by suction.

Many other modifications may be made without departing from the invention as defined in the appended claims.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A control means of the type described in which one of the movements of the operating rod is a movement transverse to its longitudinal axis and the other movement is a rotational or angular movement about its longitudinal axis.

2. A control means according to claim 1 in which the operating rod can be moved transversely or rotationally with reference to its longitudinal axis after it has been previously moved from its normal position of rest rotationally or transversely respectively with reference to its longitudinal axis.

3. A control means according to claim 1 in which the movement of the rod trans-

versely to its longitudinal axis effects the application of the brakes of both brake units and the angular or rotational movement of the rod about its longitudinal axis in one direction effects application of the brake or brakes of one brake unit only and in the other direction the brake or brakes of the other brake unit only.

4. A control means according to any of the preceding claims comprising in combination a pair of cylinders arranged side by side with their longitudinal axes parallel, pistons slidable within said cylinders, opposed tooth rack members secured to and extending rearwardly from said pistons, a toothed wheel or ring disposed between and meshing with said tooth rack members, and an operating rod which at one end carries or engages the said toothed wheel or ring, the said rod being mounted between its ends to swing transversely to its longitudinal axis in a plane which intersects at right angles, midway between the longitudinal axes of the cylinders, the plane in which said axes lie.

5. Control means according to claims 3 and 4 in which the pistons are thrust in the same direction to apply the brakes connected to their respective cylinders.

6. Control means according to claim 4 or 5 in which the toothed wheel or ring is universally carried or engaged by the operating rod.

7. A control means substantially as described with reference to the accompanying drawings.

Dated this 27th day of March, 1930.

A. G. BROWN,

Acting for the Applicants.

335,611 COMPLETE SPECIFICATION

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 2

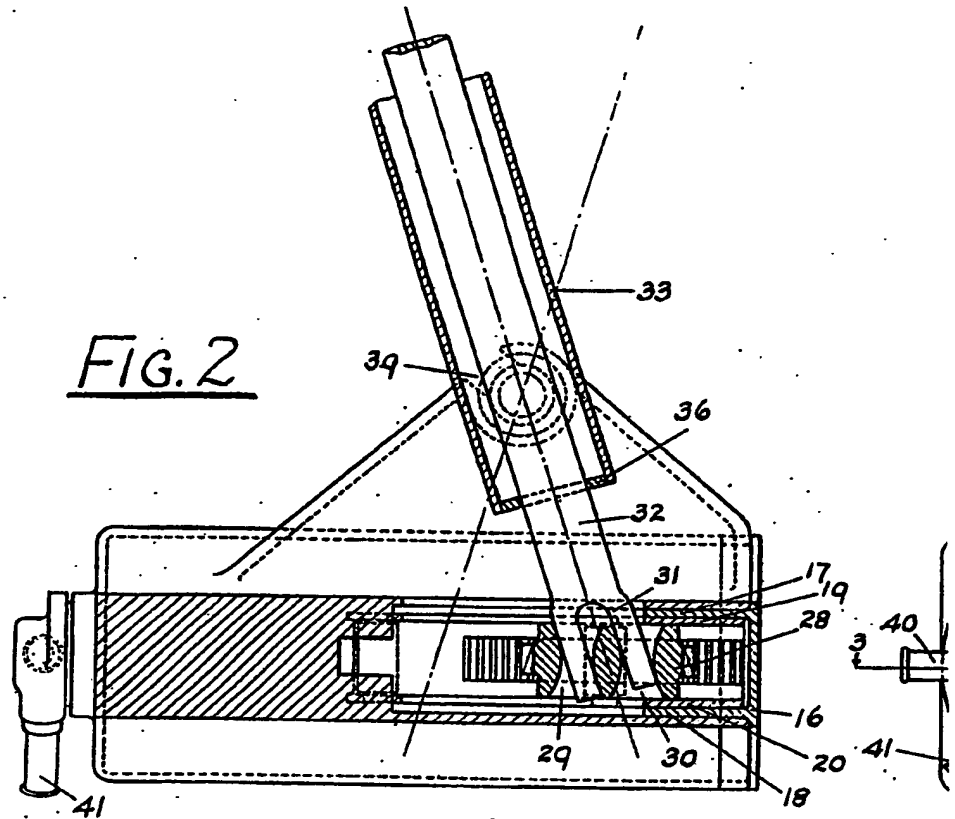
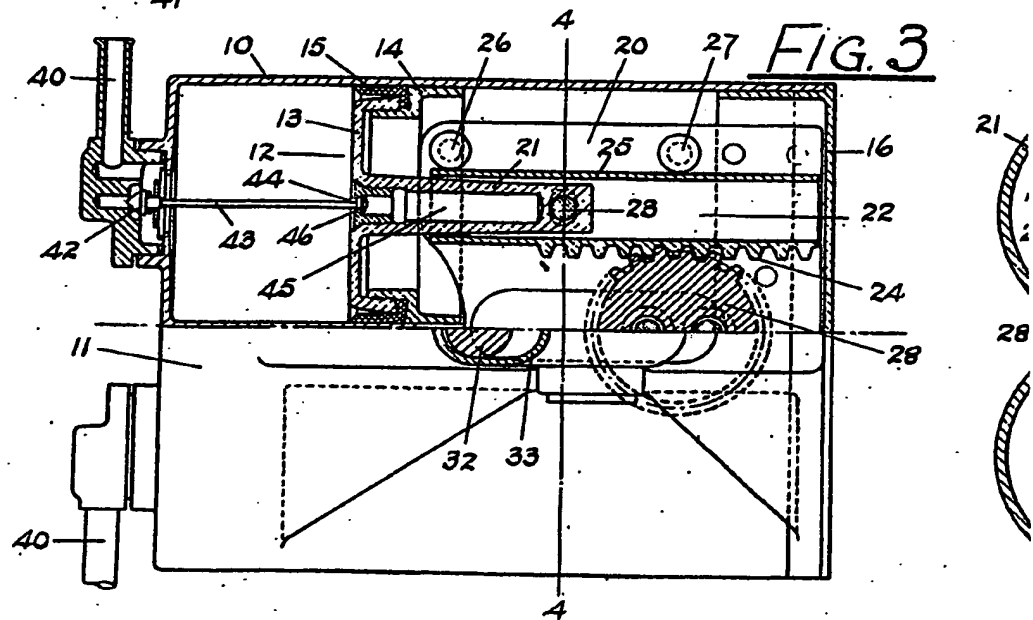


FIG. 3



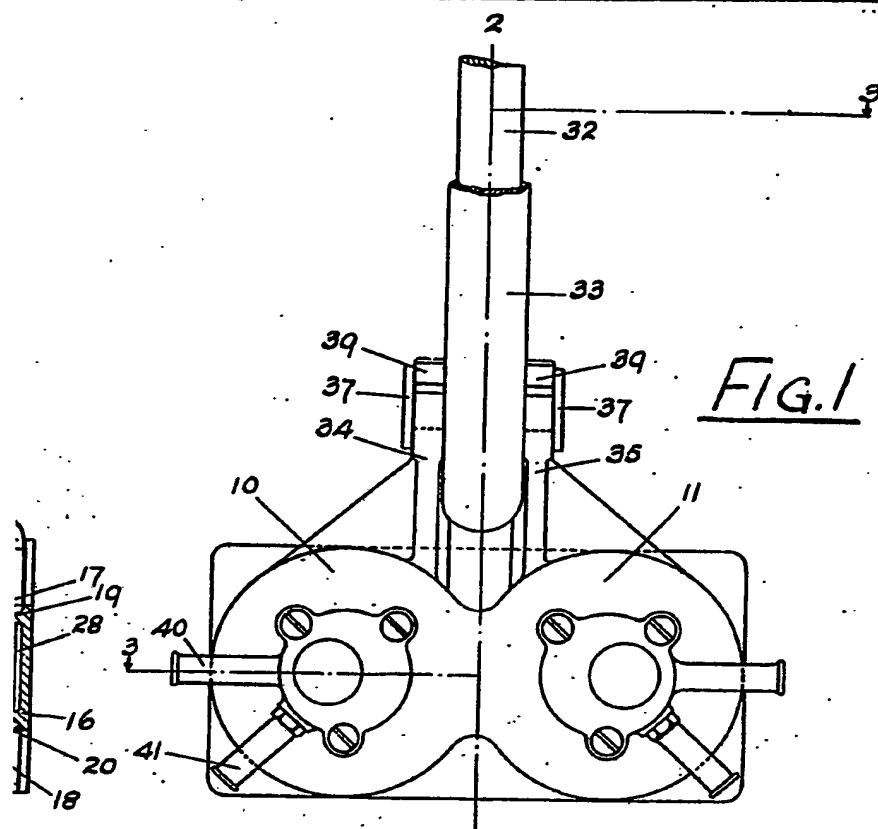


FIG. 1

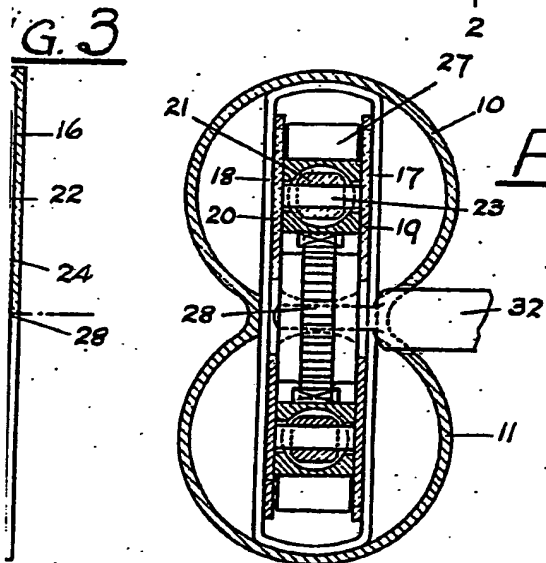


FIG. 4

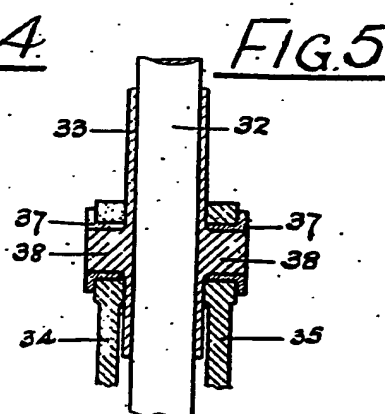
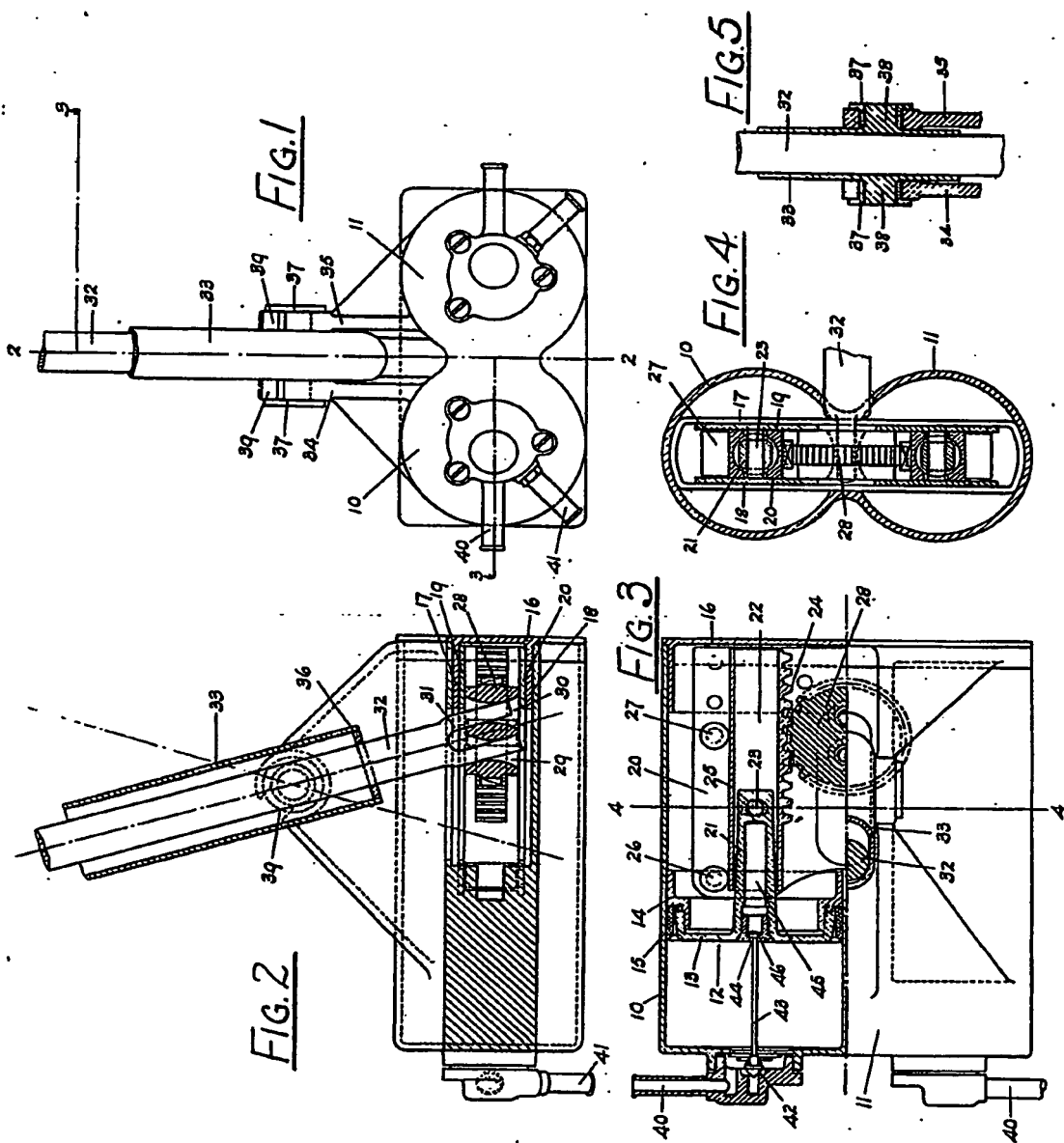


FIG. 5



335,611 COMPLETE SPECIFICATION

1 SHEET



[This Drawing is a reproduction of the Original on a reduced scale]

**THIS PAGE LEFT BLANK**